

**METHOD AND SYSTEM IN A CLIENT COMPUTER SYSTEM FOR
GENERATING AND DISPLAYING A LOCAL SERVER CLOCK
SYNCHRONIZED WITH A SERVER CLOCK USING A CLIENT CLOCK**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to data processing systems and more particularly to networked computer systems. Still more particularly, the present invention relates to a client computer system which generates and displays a local server clock which is synchronized with a server clock using a client clock.

2. Description of the Related Art

In typical data processing systems, a client computer system may be coupled to an Internet server computer system. The client may request data from the server which the server then transmits to the client, often in the form of Web pages. When the client receives a Web page, the data displayed on a page is static. The data is not dynamically updated from the server as the server receives updates to the data. Therefore, the data displayed on a client may become quickly outdated.

A frequently utilized service provided by an Internet server is an auction service. The auction service may list an item to be auctioned. The length of time the server will accept bids on a particular item is limited and ends at a predetermined date and time. The predetermined date and time are calculated utilizing the

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time indicated by the server clock. The server may be located physically far away from a client which accesses the server. For example, the server may be located in one time zone while the client resides in another, 5 different time zone. This creates the need for a user to perform a calculation as to the length of time the auction will be open.

In addition, it may be advantageous to a potential buyer to wait until the last minutes of an auction before 10 submitting a bid. In this case, the buyer must calculate precisely when an auction closes. Because the internal clocks of different computer systems are not synchronized, this calculation can become tedious possibly resulting in a lost bidding opportunity when the 15 auction closes earlier than the potential buyer had calculated.

Therefore, a need exists for a method and system for generating and displaying a local server clock which is synchronized with a server clock using a client clock 20 from which various counter values may be derived and displayed. A need exists to indicate to a user how long it has been since the data being viewed has been refreshed, or updated.

SUMMARY OF THE INVENTION

A data processing system and method are disclosed for generating and displaying a local server clock which is synchronized with a server clock using a client clock.

- 5 The data processing system includes a server computer system, which includes a server clock, and a client computer system, which includes a display and a client clock. Data is requested by the client from the server computer system to be displayed on the client computer system's display. The data is then received in the client computer system. The client computer system determines a current time indicated by the server clock. The client computer system generates a local server clock. Thereafter, the local server clock is updated
10 utilizing the client clock. The local server clock and the data are then displayed together on the client's display.

- The above as well as additional objectives, features, and advantages of the present invention will
20 become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description when taken in conjunction with the figures presented herein provide a complete disclosure of the invention.

5 **Figure 1** depicts a general architecture of an Interactive Offer Server ("IOS") in which the present invention may be implemented;

Figure 2 is an exemplary block diagram of a server according to the present invention;

10 **Figure 3** is an exemplary block diagram of a client according to the present invention;

Figure 4 illustrates a high level flow chart which depicts creating a local server clock and counters in a client according to the present invention;

15 **Figure 5** depicts a high level flow chart which illustrates synchronizing the display of a local server clock with a server clock utilizing a client clock in accordance with the present invention.

Figure 6 illustrates a high level flow chart which depicts the creation and utilization of a time remaining counter in accordance with the present invention;

20 **Figure 7** depicts a screen image within which a local server clock and a refresh counter is illustrated in accordance with the present invention;

25 **Figure 8** illustrates a screen image within which a local server clock and a time remaining icon and its associated time remaining counter is illustrated when the time remaining is greater than a specified parameter in accordance with the present invention;

Figure 9 depicts a screen image within which a local server clock and a time remaining icon is illustrated in accordance with the present invention; and

Figure 10 depicts a screen image within which a local server clock and a time remaining counter is illustrated which is displayed in response to a selection of the time remaining icon of **Figure 9** when the time remaining is less than a specified parameter in accordance with the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

The present method and system is preferably realized in a plurality of networked computers, including computer network terminals or consoles, networked
5 database application servers, web servers, and a computer network. The computer network consoles employed are any suitable device for accessing remote application services over a computer network, including, but not limited to: personal computer-based web browsers, wireless web
10 browsers such as web-enabled wireless telephones and personal digital assistants ("PDA"), Internet appliances, and dedicated computer terminals. The database application servers employable in the invention may be any of a wide array of available database application
15 servers, including, but not limited to: IBM Lotus Notes servers, Oracle servers, etc. The web servers incorporated into the invention may be any suitable platform, including, but not limited to: IBM's WebSphere product, Apache Hyper Text Transfer Protocol ("HTTP")
20 servers, secure HTTP servers ("HTTPS"), and the like. The computer network may include the Internet, intranets, extranets, dedicated networks such as local area networks ("LAN") and wide area networks ("WAN"), wireless data networks, and/or any other suitable computer and data
25 communications network. Communications means between database application servers, computer network consoles, and web servers may include any suitable data communications protocols and media including, but not limited to: dial-up modems over telephone lines,
30 wireless data transceivers, cable modems, Digital

Subscriber Lines ("DSL"), and dedicated data communication lines.

It will be recognized by those skilled in the art that certain combinations and integrations of the features presented herein may be made without departing from the spirit and scope of the invention. Further, it will be recognized that many of the architectural details disclosed herein are disclosed under the inventor's preferred embodiment in order to enhance the robustness and reliability of the invention, but these details may not be necessary to realize the fundamental functionality of the invention.

The present invention is method and system for a client computer system generating and displaying a local server clock which is synchronized with a server clock utilizing a client clock. The client is coupled to a server. The client includes the client clock, and the server includes the server clock. The local server clock is generated within the client to be synchronized with the server clock.

Data may be requested by the client from the server. For example, the client may request that the server transmit a particular Web page to the client. When the client requests the Web page from the server, the client can also access the server clock to determine the current time indicated by the server clock. The client first sets a local server clock to the current time of the server clock.

When setting the local server clock, the client must determine the amount of network delay which occurred after the client transmitted a request to obtain the current time indicated by the server clock and before the

server clock time was returned to the client. There are several methods currently known in the art which may be used to determine this network delay. Any suitable method may be utilized to determine network delay.

5 In accordance with the present invention, the local server is set equal to the time returned to the client in response to the client's request for the time plus the network delay. Thereafter, the local server clock is incremented and controlled only by the client using the
10 client clock. In this manner, the client is capable of determining a very close approximation of the time currently indicated by the server clock without subsequently accessing the server clock.

Once the local server clock is set and indicating an
15 approximation of the time indicated by the server clock, the local server clock may be utilized to provide time-sensitive information to the user. For example, an auction item may be displayed on the requested Web page. An auction item typically includes a date and time when
20 the auction for the item will close such that no other bids will be accepted. The local server clock may be used to calculate the time remaining before the auction closes.

An icon is associated and displayed for each item
25 being auctioned. When an icon is selected, a window is displayed. A time-remaining counter is provided which indicates the amount of time remaining before the auction for the associated item closes. The remaining time is calculated utilizing the local server clock and the date
30 and time when the auction closes. The time-remaining counter is decremented utilizing the client clock.

In addition, a time-remaining parameter may be provided by a user. For example, user preferences may be obtained utilizing a user preferences screen where each user could specify the parameter. For some users the parameters may be any number of days. Other user could select a shorter time. If the time remaining before the auction closes is greater than the parameter, a statement will be displayed in the window which states that the remaining time is greater than the value of the parameter. If, however, the time remaining is less than the parameter, the current value of the time-remaining counter will be displayed. When the window is closed, the time-remaining counter is stopped.

The time-remaining display is an absolute time. For example, the display may indicate that there are more than a particular number of days left for the auction. Or, the display may indicate that the auction will close in 47 minutes. The time remaining is not dependent on time zones. Therefore, the potential buyer does not need to made any calculations to determine how soon close the auction will close.

Frequently it is useful to know how much time has passed since the Web page was refreshed. To provide this feature, a refresh counter is provided within the client. When a Web page is received, a refresh counter is reset to zero and then started incrementing. The increments of the counter are controlled by the client clock. The refresh counter is displayed on the page. When the Web page is refreshed, by receiving updated information from the server, the refresh counter is again reset to zero and then incremented utilizing the client clock. In this manner, a user can immediately determine how much time

has passed since the data displayed on the Web page was updated.

Turning to **Figure 1**, in which the general architecture of the system of the invention is shown, an Interactive Offer Server ("IOS") **51** is associated with an offering database **52**. The offering system **50** is included in the larger architecture **59** which includes the brokers' consoles **58**, the administrator console **56**, and the traders' consoles **54**. All consoles and the interactive offering server may communicate either as an integrated package within one computer system, or as separate computer systems integrated and communicating over a computer network such as the Internet.

In the general architecture of **Figure 1**, the manufacturer or service provider's goods availability list **55** is received by the trader consoles **54**. The trader then creates proposed offerings by filtering the availability list against the broker profile matrices **40** for his broker(s). Those proposed offerings are input into the offering data base **52**, which are then retrieved by the administrator using his administrator console **56**.

The administrator then authorizes the proposed offerings and makes a note or change in the offering data base records to indicate such authorization.

During the open bidding process, the brokers may use their consoles, such as web browser personal computers **58**, to retrieve their offerings, and to submit bids via the IOS **51**. When a broker makes contact with the interactive offering server, his identity is first verified by an Authentication Server **57**, according to the preferred embodiment.

In response to the broker's request for products or services offerings, the IOS queries the offering database 52 and presents the broker with offerings to which he or she is entitled. An authentication server 57 is included in the preferred embodiment so as to allow the interactive offering server to authenticate the broker prior to presenting any offerings to the broker. As such, the general architecture 59 as shown in **Figure 1** provides each broker with one or more offerings which have been authorized and which have been filtered only to show available materials or services on which he is entitled to bid.

Figure 2 illustrates a block diagram of a data processing system which may be implemented as IOS server 51 in accordance with a preferred embodiment of the present invention. Data processing system 200 may be a symmetric multiprocessor (SMP) system including a plurality of processors 202 and 204 connected to system bus 206. Alternatively, a single processor system may be employed. Also connected to system bus 206 is memory controller/cache 208, which provides an interface to local memory 209. I/O bus bridge 210 is connected to system bus 206 and provides an interface to I/O bus 212. Memory controller/cache 208 and I/O bus bridge 210 may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge 214 connected to I/O bus 212 provides an interface to PCI local bus 216. A number of modems may be connected to PCI bus 216. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors. Communications links to other network computers may be

provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards.

Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, data processing system **200** allows connections to multiple network computers. A memory-mapped graphics adapter **230** and hard disk **232** may also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000 system, a product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

Figure 3 depicts a block diagram which illustrates a data processing system which may be implemented as one or more broker consoles **58**. Data processing system **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used. Processor **302** and main memory **304** are

connected to PCI local bus 306 through PCI bridge 308.

PCI bridge 308 also may include an integrated memory controller and cache memory for processor 302. Additional connections to PCI local bus 306 may be made through

5 direct component interconnection or through add-in boards.

In the depicted example, local area network (LAN) adapter 310, SCSI host bus adapter 312, and expansion bus

interface 314 are connected to PCI local bus 306 by direct component connection. In contrast, audio adapter 316,

10 graphics adapter 318, and audio/video adapter 319 are connected to PCI local bus 306 by add-in boards inserted into expansion slots. Expansion bus interface 314

provides a connection for a keyboard and mouse adapter 320, modem 322, and additional memory 324. Small computer

15 system interface (SCSI) host bus adapter 312 provides a connection for hard disk drive 326, tape drive 328, and CD-ROM drive 330. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

20 An operating system runs on processor 302 and is used to coordinate and provide control of various components within data processing system 300 in **Figure 3**. The

operating system may be a commercially available operating system, such as Windows 2000, which is available from

25 Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system 300. "Java" is a trademark of Sun

30 Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or

programs are located on storage devices, such as hard disk drive **326**, and may be loaded into main memory **304** for execution by processor **302**.

Those of ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

As another example, data processing system **300** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **300** comprises some type of network communication interface. As a further example, data processing system **300** may be a Personal Digital Assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not meant to imply architectural limitations. For example, data processing system **300** also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing system **300** also may be a kiosk or a Web appliance.

Figure 4 illustrates a high level flow chart which depicts creating a local server clock and counters in a client according to the present invention. The process

starts as depicted by block 400 and thereafter passes to block 402 which illustrates the creation of a local server clock in a client, such as client 300. The local server clock is preferably implemented as a software variable in the client which is updated utilizing the client's clock in order to increment the variable. Thereafter, block 404 depicts the creation of a refresh counter in the client. Next, block 406 illustrates the creation of a remaining-time counter in the client. Thereafter, block 408 depicts a determination of whether or not a user specified default parameter has been specified. If a determination is made that a user specified default parameter has not been specified, the process passes to block 412 which illustrates the specification of a parameter for the remaining-time counter. This parameter will be used to determine whether to display the actual remaining time, or whether to display a single statement which indicates that the remaining time is greater than a particular value. The process then passes to block 414.

Referring again to block 408, if a determination is made that a user has specified a default parameter, the process passes to block 410 which depicts using the user specified default parameter. The process then passes to block 414.

Block 414 illustrates the specification of a decrement amount for the remaining-time counter which will be used to decrement the remaining-time counter. For example, the remaining-time counter could be decremented each minute or each second.. Preferably, the decrement amount for the remaining-time counter will be

set equal to one second. The process then passes to block 416 which depicts the specification of an increment amount which will be used to increment the local server clock. For example, the local server clock could be
5 incremented each minute or each second. Preferably, the increment amount will be set equal to one second so that the local server clock is incremented every second. Next, block 418 illustrates the specification of an increment amount for the refresh counter used to
10 increment the refresh counter. For example, the refresh counter could be incremented each minute or each second. Preferably, the refresh counter will be set equal to one second so that the local server clock is incremented every second. The process then terminates as depicted by
15 block 420.

Figure 5 depicts a high level flow chart which illustrates synchronizing the display of a local server clock with a server clock utilizing a client clock in accordance with the present invention. The process
20 starts as depicted by block 500 and thereafter passes to block 502 which illustrates the request by a client of a Web page from a server. Next, block 504 depicts resetting the refresh counter to zero. Thereafter, block 506 illustrates resetting the remaining-time counter to
25 zero. The process then passes to block 508 which depicts the client computer system accessing the server computer system to determine the time currently indicated by the server clock. Therefore, the client reads the server clock to determine the current server time.

30 Next, block 510 illustrates setting the local server clock variable equal to the current server time plus the

network delay. The local server clock variable is implemented in software in the client, and will be referred to herein as the local server clock.

Thereafter, block 512 depicts continuously incrementing
5 the local server clock each specified increment amount using the client clock to count the increments. When the increment amount for updating the local server clock is set at one second, the local server clock will be incremented each second. A second will be determined
10 using the client clock. In this manner, the local server clock will display a time which is approximately the same time currently kept on the server by the server's clock. Block 514, then, depicts displaying the Web page on the client.

15 The process then passes to block 515 which illustrates starting the refresh counter. Block 516, then, depicts continuously incrementing the counter each increment using the client clock to count the increments. Therefore, if the refresh counter increment amount is one
20 second, the refresh counter will increment each second. Next, block 518 depicts displaying the current value of the refresh counter on the displayed Web page. Thereafter, block 520 illustrates displaying the current local server clock time on the displayed Web page. The
25 process then passes to block 546.

Block 546 illustrates a determination of whether or not the Web page is to be closed or refreshed. If a determination is made that the Web page is not to be either closed or refreshed, the process passes back to
30 block 515. Referring again to block 546, if a determination is made that the Web page is to be either

closed or refreshed, the process passes to block **548** which depicts a determination of whether or not the Web page is to be closed. If a determination is made that the Web page is to be closed, the process passes to block
5 **550** which illustrates stopping the local sever clock and the refresh counter. Next, block **552** depicts closing the Web page.

Referring again to block **548**, if a determination is made that the Web page is not to be closed, the process
10 passes to block **554** which illustrates resetting the refresh counter to zero. Thereafter, block **556** depicts refreshing the Web page. The process then passes back to block **514**.

Figure 6 depicts a high level flow chart which
15 depicts the creation and utilization of a time remaining counter in accordance with the present invention. The process starts as illustrated by block **600** and thereafter passes to block **602** which depicts opening or refreshing a Web page which displays time-sensitive offers. Next,
20 block **604** illustrates displaying a different time remaining icon associated with each displayed offer. Thereafter, block **606** depicts a determination of whether or not one of the time remaining icons has been selected. If a determination is made that none of the time
25 remaining icons have been selected, the process passes to block **626**.

Referring again to block **606**, if a determination is made that one of the time remaining icons has been selected, the process passes to block **608** which
30 illustrates determining the date and time the offer closes which is associated with the selected icon. Next,

block 610 depicts determining the amount of time remaining until the offer closes using the local server clock. Thereafter, block 612 illustrates setting the time-remaining counter equal to the time remaining which was determined as depicted by block 610. Block 614, then depicts a determination of whether or not the time currently remaining until the offer closes is greater than or equal to the time-remaining parameter. If a determination is made that the time currently remaining is greater than or equal to the parameter, the process passes to block 616 which illustrates displaying a window within which the time currently remaining is displayed using a statement of the parameter. For example, if the parameter is set at seven days and the time currently remaining is greater than or equal to seven days, block 616 depicts displaying a statement in the window which states that the current time remaining is greater than seven days. The process then passes to block 622.

Referring again to block 614, if a determination is made that the time currently remaining is less than the parameter, the process passes to block 618 which illustrates displaying a window within which the time currently remaining is displayed by displaying the current value of the time-remaining counter. Next, block 620 depicts decrementing the time remaining counter each decrement amount. Thereafter, block 622 illustrates a determination of whether or not the time remaining window is to be closed. If a determination is made that the time remaining window is not to be closed, the process passes back to block 614. Referring again to block 622, if a determination is made that the time remaining window

is to be closed, the process passes to block **624** which depicts stopping the time remaining counter and closing the time remaining counter window. The process then passes to block **626**.

5 Block **626** illustrates a determination of whether or not this Web page is to be closed. If a determination is made that this Web page is not to be closed, the process passes to block **606**. Referring again to block **626**, if a determination is made that this Web page is to be closed,
10 the process passes to block **628** which illustrates closed this Web page.

Figure 7 depicts a screen image within which a local server clock and a refresh counter is illustrated in accordance with the present invention. The local server
15 clock currently indicates the server time being 3:47:56 p.m. The refresh counter indicates that the data displayed in this page was last updated 535 seconds ago.

Figure 8 illustrates a screen image within which a local server clock and a time remaining icon and its
20 associated time remaining counter is illustrated when the time remaining is greater than a specified parameter in accordance with the present invention. The local server clock currently indicates the server time being 4:19:27 p.m. The time remaining icon has been selected and a
25 time remaining window is displayed. The parameter is currently set at 7 days. Therefore, the time remaining before the close of the associated offer is more than 7 days. A single statement is therefore displayed.

Figure 9 depicts a screen image within which a local
30 server clock and a time remaining icon is illustrated in accordance with the present invention. The local server

clock currently indicates the server time being 4:08:07 p.m.

Figure 10 depicts a screen image within which a local server clock and a time remaining counter is illustrated which is displayed in response to a selection of the time remaining icon of **Figure 9** when the time remaining is less than a specified parameter in accordance with the present invention. The local server clock now indicates the server time being 4:08:49 p.m.

The time remaining icon shown in **Figure 9** was selected and a time remaining window is now displayed. The time remaining before the close of the offer is currently less than 7 days. Therefore, the time remaining counter is displayed which will continue to count down to the close of the offer.

It will be understood by those skilled in the art and from the foregoing description that various modifications and changes may be made in the preferred embodiment of the present invention without departing from its spirit and scope. It is intended that this description is for purposes of illustration only and should not be construed in a limiting sense. The scope of this invention should be defined by the following claims.